

CLAIMS

1. A bipolar junction transistor (BJT) mixer for low supply voltage, comprising:
 - a pull-up BJT having a collector connected to a power supply through a load device, an emitter; and a base fed with a first dc base current;
 - a pull-down BJT having a collector connected to the emitter of said pull-up transistor, an emitter connected to a negative power supply, and a base fed from a second dc base current larger than said first dc base current so as to cause the collector of said pull-down BJT operating at the knee of I_C vs V_{CE} collector characteristics;
 - a first signal fed to said base of said pull-down BJT;
 - a second signal fed to said base of said pull-down BJT; and
 - an output collector current of said pull-up transistor proportional to the product of said first signal and said second signal.
2. The BJT mixer as described in claim 1, wherein said second dc base current is approximately equal to twice that said first dc base current.
3. The BJT mixer as described in claim 1, wherein said first signal is capacitively coupled to said base of said pull-down BJT, and said second is capacitively coupled to said base of said pull-up BJT.
4. The BJT mixer as described in claim 1, wherein said pull-up BJT and said pull-down BJT are inverted with the collector serving as an emitter and the emitter serving as a collector.
5. The BJT mixer as described in claim 1, further comprising an inverted BJT connected in parallel with said pull-up BJT, and a second inverted BJT connected in parallel with said pull-down BJT.
6. The BJT mixer as described in claim 1, further comprising a first current mirror for mirroring said first dc base current, and a second current mirror for mirroring said second dc base current.
7. The BJT mixer as described in claim 6, wherein said first current mirror comprises two complementary transistors fed from a first base current of a common collector BJT amplifier with a first series emitter resistance, and said second current comprises two complementary transistors fed from a second base current of a second common collector amplifier with a second series emitter resistor.
8. The BJT mixer as described in claim 7, wherein each of said current mirror comprises two p-channel MOSFETs.
9. The BJT mixer as described in claim 1, where the base current of the pull-up BJT is fed through an ohmic resistor to a positive voltage supply.

10. The BJT mixer as described in claim 9, further comprising a diode-connected BJT between the base and emitter each of the pull-up BJT and the pull-down BJT so as to stabilize the beta to a nearly constant value.

11. The BJT mixer as described in claim 1, wherein said first signal is an RF signal and said second signal is a local oscillator signal, and said output collector current is a beat frequency signal of said first signal and said second signal.

12. The BJT mixer as described in claim 1, wherein said first signal is a local oscillator signal, and said second signal is an RF signal, and said output collector current is a beat frequency signal of said first signal said second signal.